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10/589,349	08/11/2006	Jun'ichi Abe	2611-0258PUS1	8178

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EXAMINER

LIU, LI

ART UNIT	PAPER NUMBER
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2613

NOTIFICATION DATE	DELIVERY MODE
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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Office Action Summary	Application No. 10/589,349	Applicant(s) ABE ET AL.	
	Examiner LI LIU	Art Unit 2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 June 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12, 14-23 and 25-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12, 14-23 and 25-37 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/17/2010 has been entered.

Response to Arguments

2. Applicant's arguments filed 6/17/2010 have been fully considered but they are not persuasive.

1). Applicant's argument – "Tomizawa cannot teach or suggest an operational circuit (claims 12 and 22) or the corresponding step (claims 23 and 33) that sets one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator and performs said predetermined logical operation with the set predetermined threshold value and discrimination results output from the discriminators".

Examiner's response – As discussed in the previous Final Office Action filed on 3/18/2010, Tomizawa teaches or suggest to set the predetermined thresholds to

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different values, in response to corresponding predetermined logical operation, and performs the predetermined logical operation with the set predetermined threshold value and discrimination results output from the discriminators.

Tomizawa et al discloses that the plurality of predetermined thresholds have different values (e.g., V_{th1} , V_{th2} , ... V_{thn}). When a single discriminator is used, the optimum threshold for the single discriminator has only one value (e.g., V_{opt}). That is, at least one of the predetermined thresholds (V_{th1} , V_{th2} , ... V_{thn}) has a value that is different from the optimum threshold value (V_{opt}) that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator. Therefore, Tomizawa teach or suggest to set one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator and performs said predetermined logical operation with the set predetermined threshold value and discrimination results output from the discriminators

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 12 and 14-22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter

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which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

1). Claim 12, and thus depending claims 14-21, recites the limitation “an operational circuit that sets one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator”. However, according to the original disclosure, the operational circuit is used to perform predetermined logical operation (e.g., OR or AND). The original disclosure does not disclose that the operational circuit sets one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

2). Claim 22 recites the limitation “an operational circuit that sets one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator”. However, according to the original disclosure, the operational circuit is

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used to perform predetermined logical operation (e.g., OR or AND). The original disclosure does not disclose that the operational circuit sets one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 12, 14, 16, 18, 22, 23, 25, 27, 29 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al (US 2003/0118345).

1). With regard to claim 12, Tomizawa et al discloses an optical receiver (e.g., Figures 3-10) comprising:

an optical divider (e.g., the distribution circuit in Figures 3, 8 and 9 etc) that divides an optical input signal into a plurality of paths;

a plurality of optical-to-electrical converters (e.g., the photodetectors in Figures 3, 8 and 9 etc) that respectively converts the divided optical input signals into electrical signals;

a plurality of discriminators (e.g., the decision circuits in Figures 3, 8 and 9 etc) that respectively outputs discrimination results by discriminating the electrical signals output from the optical-to-electrical converters based on predetermined thresholds (the predetermined thresholds: threshold value 1, threshold value 2 etc, or threshold value H, threshold value L etc are used by the discriminators); and

an operational circuit (e.g., the Consensus Logic 4 with the Selection Circuit 5 in Figures 3, 8 and 9 etc) that performs a predetermined logical operation with the predetermined threshold value and discrimination results output from the discriminators ([0045], [0069], [0070] and [0072] etc).

Tomizawa et al also teaches to set one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator and performs a predetermined logical operation with the set predetermined threshold value (Figures 3, 8 and 9, Tomizawa discloses that the plurality of predetermined thresholds having different values, e.g., threshold value 1, threshold value 2, threshold value 3 etc, are set. When a single discriminator is used, the optimum threshold for the single discriminator has only one value, e.g., V_{opt} . That is, at least one of the predetermined thresholds (threshold value 1, threshold value 2, threshold value 3 etc) has a value that

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is different from the optimum threshold value V_{opt} that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator. Also refer to the 112 rejection above).

Tomizawa et al teaches that the predetermined thresholds (e.g., the threshold values 1-n or threshold values H and L) are imparted to the plurality of discriminators. But, Tomizawa et al does not expressly disclose wherein said predetermined thresholds imparted to the plurality of discriminators are determined according to a predetermined logical operation, and then the operational circuit performs the predetermined logical operation.

However, Tomizawa et al discloses “when the threshold values of the decision circuits 3-11 and 3-12 are set lower than the standard threshold value, the same effect can be achieved by inverting the above logic” ([0072]). That is, when the threshold values is changed, a different logic operation is used; or different decision threshold uses different logic operation, and the logic operation can based on the selected decision thresholds. Tomizawa teaches that the levels of the decision threshold and the logical operation are related with each other (logical operation \propto decision threshold), therefore, it is obvious to one skilled in the art that the thresholds imparted to the plurality of discriminators can also be determined according to a selected logical operation (decision threshold \propto logical operation).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the strategy of choosing proper threshold values based on the selected logical operation to the system of Tomizawa et al so that the

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receiver can discriminate the input signal more accurately, and the system reliability can be enhanced.

2). With regard to claim 14, Tomizawa et al discloses all of the subject matter as applied to claim 12 above, and Tomizawa et al further discloses wherein

the optical divider is an optical polarization divider (Figure 6, polarization beam splitter can be used to divide the input signal) that divides the optical input signal based on a polarization state of the optical input signal ([0061], "[t]he polarization beam splitter 25 splits optical signals of two polarization modes into each polarization").

3). With regard to claim 16, Tomizawa et al discloses all of the subject matter as applied to claim 12 above, and Tomizawa et al further discloses wherein the predetermined thresholds of the discriminators are substantially equal (e.g., Figure 8, the predetermined thresholds of the discriminators are substantially equal: the threshold value H).

4). With regard to claim 18, Tomizawa et al discloses all of the subject matter as applied to claim 12 above, and Tomizawa et al further discloses wherein the operational circuit is a logical OR circuit (e.g., Figure 8 and [0070]-[0072]).

5). With regard to claim 22, Tomizawa et al discloses an optical communication system (e.g., Figures 3-10) comprising:

an optical transmitter (e.g., the optical transmitter shown in Figures 5-7) that transmits an optical signal; and

an optical receiver (e.g., Figures 3-10) that receives the optical signal transmitted from the optical transmitter, wherein

the optical receiver includes

- an optical divider (e.g., the distribution circuit in Figures 3, 8 and 9 etc) that divides the received optical signal into a plurality of paths;
- a plurality of optical-to-electrical converters (e.g., the photodetectors in Figures 3, 8 and 9 etc) that respectively converts the divided optical input signals into electrical signals;
- a plurality of discriminators (e.g., the decision circuits in Figures 3, 8 and 9 etc) that respectively outputs discrimination results by discriminating the electrical signals output from the optical-to-electrical converters based on predetermined thresholds (the predetermined thresholds: threshold value 1, threshold value 2 etc, or threshold value H, threshold value L etc are used by the discriminators); and
- an operational circuit (e.g., the Consensus Logic 4 with the Selection Circuit 5 in Figures 3, 8 and 9 etc) that performs a predetermined logical operation with the predetermined threshold value and discrimination results output from the discriminators ([0045], [0069], [0070] and [0072] etc).

Tomizawa et al also teaches to set one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator and performs a predetermined logical operation with the set predetermined threshold value (Figures 3, 8 and 9, Tomizawa discloses that the plurality of predetermined thresholds having different values, e.g., threshold value 1, threshold value 2, threshold value 3 etc, are

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set. When a single discriminator is used, the optimum threshold for the single discriminator has only one value, e.g., V_{opt} . That is, at least one of the predetermined thresholds (threshold value 1, threshold value 2, threshold value 3 etc) has a value that is different from the optimum threshold value V_{opt} that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator. Also refer to the 112 rejection above).

Tomizawa et al teaches that the predetermined thresholds (e.g., the threshold values 1-n or threshold values H and L) are imparted to the plurality of discriminators. But, Tomizawa et al does not expressly disclose wherein said predetermined thresholds imparted to the plurality of discriminators are determined according to a predetermined logical operation, and then the operational circuit performs the predetermined logical operation.

However, Tomizawa et al discloses "when the threshold values of the decision circuits 3-11 and 3-12 are set lower than the standard threshold value, the same effect can be achieved by inverting the above logic" ([0072]). That is, when the threshold values is changed, a different logic operation is used; or different decision threshold uses different logic operation, and the logic operation can based on the selected decision thresholds. Tomizawa teaches that the levels of the decision threshold and the logical operation are related with each other (logical operation \propto decision threshold), therefore, it is obvious to one skilled in the art that the thresholds imparted to the plurality of discriminators can also be determined according to a selected logical operation (decision threshold \propto logical operation).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the strategy of choosing proper threshold values based on the selected logical operation to the system of Tomizawa et al so that the receiver can discriminate the input signal more accurately, and the system reliability can be enhanced.

6). With regard to claim 23, Tomizawa et al discloses an optical reception method (e.g., Figures 3-10) comprising:

dividing, by an optical divider (e.g., the distribution circuit in Figures 3, 8 and 9 etc), an optical input signal into a plurality of paths;

converting the divided optical input signals into respective electrical signals (e.g., the photodetectors, in Figures 3, 8 and 9 etc, respectively converts the divided optical input signals into electrical signals);

outputting discrimination results by discriminating the respective converted electrical signals by utilizing a plurality of discriminators (e.g., the decision circuits in Figures 3, 8 and 9 etc) based on predetermined thresholds (e.g., the decision circuits in Figures 3, 8 and 9 etc respectively outputs discrimination results by discriminating the electrical signals based on predetermined thresholds. E.g., the predetermined thresholds: threshold value 1, threshold value 2 etc, or threshold value H, threshold value L etc are used by the discriminators);

setting one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality

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of paths with a single discriminator (Figures 3, 8 and 9, Tomizawa discloses that the plurality of predetermined thresholds having different values, e.g., threshold value 1, threshold value 2, threshold value 3 etc, are set. When a single discriminator is used, the optimum threshold for the single discriminator has only one value, e.g., V_{opt} . That is, at least one of the predetermined thresholds (threshold value 1, threshold value 2, threshold value 3 etc) has a value that is different from the optimum threshold value V_{opt} that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator. Also refer to the 112 rejection above); and

performing said predetermined logical operation with the predetermined threshold and the outputted discrimination results (e.g., the Consensus Logic 4 with the Selection Circuit 5 in Figures 3, 8 and 9 etc performs a predetermined logical operation with the predetermined threshold and the discrimination results output from the decision circuits; [0045], [0069], [0070] and [0072] etc).

Tomizawa et al teaches that the predetermined thresholds (e.g., the threshold values 1-n or threshold values H and L) are imparted to the plurality of discriminators. But, Tomizawa et al does not expressly disclose wherein said predetermined thresholds imparted to the plurality of discriminators are determined according to a predetermined logical operation, and then performing the predetermined logical operation.

However, Tomizawa et al discloses “when the threshold values of the decision circuits 3-11 and 3-12 are set lower than the standard threshold value, the same effect can be achieved by inverting the above logic” ([0072]). That is, when the threshold values is changed, a different logic operation is used; or different decision threshold

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uses different logic operation, and the logic operation can be based on the selected decision thresholds. Tomizawa teaches that the levels of the decision threshold and the logical operation are related with each other (logical operation \propto decision threshold), therefore, it is obvious to one skilled in the art that the thresholds imparted to the plurality of discriminators can also be determined according to a selected logical operation (decision threshold \propto logical operation).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the strategy of choosing proper threshold values based on the selected logical operation to the system/method of Tomizawa et al so that the receiver can discriminate the input signal more accurately, and the system reliability can be enhanced.

7). With regard to claim 25, Tomizawa et al discloses all of the subject matter as applied to claim 23 above, and Tomizawa et al further discloses wherein

dividing the optical input signal based on a polarization state of the optical input signal (Figure 6, polarization beam splitter can be used to divide the input signal; [0061], "[t]he polarization beam splitter 25 splits optical signals of two polarization modes into each polarization").

8). With regard to claim 27, Tomizawa et al discloses all of the subject matter as applied to claim 23 above, and Tomizawa et al further discloses wherein

the predetermined thresholds of the discriminators are substantially equal (e.g., Figure 8, the predetermined thresholds of the discriminators are substantially equal: the threshold value H).

9). With regard to claim 29, Tomizawa et al discloses all of the subject matter as applied to claim 23 above, and Tomizawa et al further discloses wherein the operational circuit is a logical OR circuit (e.g., Figure 8 and [0070]-[0072]).

10). With regard to claim 33, Tomizawa et al discloses an optical communication method comprising:

transmitting an optical signal (e.g., the optical transmitter shown in Figures 5-7 that transmits an optical signal); and

receiving the optical signal transmitted (e.g., the receiver Figure 3-10 receives optical signal transmitted), wherein

the receiving includes:

dividing, by an optical divider, an optical input signal into a plurality of paths (e.g., the distribution circuit, in Figures 3, 8 and 9 etc, divides the received optical signal into a plurality of paths);

converting the divided optical input signals into respective electrical signals (e.g., the photodetectors, in Figures 3, 8 and 9 etc, respectively converts the divided optical input signals into electrical signals);

outputting discrimination results by discriminating the respective converted electrical signals by utilizing a plurality of discriminators (e.g., the decision circuits in Figures 3, 8 and 9 etc) based on predetermined thresholds (e.g., the decision circuits in Figures 3, 8 and 9 etc respectively outputs discrimination results by discriminating the respective converted electrical signals based on predetermined thresholds. E.g., the

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predetermined thresholds: threshold value 1, threshold value 2 etc, or threshold value H, threshold value L etc are used by the discriminators);

setting one of the predetermined thresholds to a value, in response to corresponding predetermined logical operation, different from an optimum threshold value that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator (Figures 3, 8 and 9, Tomizawa discloses that the plurality of predetermined thresholds having different values, e.g., threshold value 1, threshold value 2, threshold value 3 etc, are set. When a single discriminator is used, the optimum threshold for the single discriminator has only one value, e.g., V_{opt} . That is, at least one of the predetermined thresholds (threshold value 1, threshold value 2, threshold value 3 etc) has a value that is different from the optimum threshold value V_{opt} that is used when discriminating the optical input signals divided into the plurality of paths with a single discriminator. Also refer to the 112 rejection above); and

performing said predetermined logical operation with the outputted discrimination results (e.g., the Consensus Logic 4 with the Selection Circuit 5 in Figures 3, 8 and 9 etc performs a predetermined logical operation with the predetermined threshold value and the outputted discrimination results, [0045], [0069], [0070] and [0072] etc).

Tomizawa et al teaches that the predetermined thresholds (e.g., the threshold values 1-n or threshold values H and L) are imparted to the plurality of discriminators. But, Tomizawa et al does not expressly disclose wherein said predetermined thresholds are determined according to a predetermined logical operation, and then performing the predetermined logical operation with the predetermined threshold value.

However, Tomizawa et al discloses “when the threshold values of the decision circuits 3-11 and 3-12 are set lower than the standard threshold value, the same effect can be achieved by inverting the above logic” ([0072]). That is, when the threshold values is changed, a different logic operation is used; or different decision threshold uses different logic operation, and the logic operation can based on the selected decision thresholds. Tomizawa teaches that the levels of the decision threshold and the logical operation are related with each other (logical operation \propto decision threshold), therefore, it is obvious to one skilled in the art that the thresholds imparted to the plurality of discriminators can also be determined according to a selected logical operation (decision threshold \propto logical operation), and then the operational circuit .

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the strategy of choosing proper threshold values based on the selected logical operation to the system and method of Tomizawa et al so that the receiver can discriminate the input signal more accurately, and the system reliability can be enhanced.

7. Claims 15 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al (US 2003/0118345) as applied to claims 12, 14, 23 and 25 above, and in further view of Naito et al (US 5,052,051).

1). With regard to claim 15, Tomizawa et al disclose all of the subject matter as applied to claims 12 and 14 above, but Tomizawa et al does not expressly disclose an optical polarization controller provided at a pre-stage of the optical polarization divider; a plurality of power monitoring units that respectively monitors optical signal powers on

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the paths; and a control circuit that controls the optical polarization controller based on the optical signal powers, wherein the control circuit controls the optical polarization controller such that output values of the optical signal powers monitored by the optical monitors become substantially equal.

In Figure 6, Tomizawa et al discloses that a polarization splitter can be used to divide the input signal. However, for a system as shown in Figure 8, or a transmitter as shown in Figures 5 and 7, when a polarization beam splitter is used to divide the input signal, a polarization controller is necessary, otherwise the discriminator and logic circuit cannot properly make the correct decision because of the power difference. Naito et al, teaches a polarization control system, in which an optical polarization controller (e.g., polarization operating apparatus 20 in Figures 2 and 3) provided at a pre-stage of the optical polarization divider (e.g., polarization splitter 23 in Figures 2 and 3); a plurality of power monitoring units (e.g., the receivers 24 and 25 together with the differential amplifier 28; or the power monitors 42 and 43 in Figure 3) that respectively monitors optical signal powers on the paths; and a control circuit (e.g., the polarization control circuit 29 in Figures 2 and 3) that controls the optical polarization controller based on the optical signal powers (e.g., based on the differential signal b from the differential amplifier 28), wherein the control circuit controls the optical polarization controller such that output values of the optical signal powers monitored by the optical monitors become substantially equal (column 3, line 52-56, and column 4 line 53-57, to minimize the signal "b", that is, output values of the optical signal powers monitored by the optical monitors become substantially equal).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the polarization control mechanism as taught by Naito et al to the system of Tomizawa et al so that the power to the two paths can be substantially equal, and the discriminators can use the substantially same decision threshold and make a desired decision, and then the system reliability can be increased.

2). With regard to claim 26, Tomizawa et al disclose all of the subject matter as applied to claims 23 and 25 above, but Tomizawa et al does not expressly disclose monitoring the respective optical signal powers on the paths; and controlling the optical polarization based on the optical signal powers such that output values of the monitored optical signal powers become substantially equal.

In Figure 6, Tomizawa et al discloses that a polarization splitter can be used to divide the input signal. However, for a system as shown in Figure 8, or a transmitter as shown in Figures 5 and 7, when a polarization beam splitter is used to divide the input signal, a polarization controller is necessary, otherwise the discriminator and logic circuit cannot properly make the correct decision because of the power difference. Naito et al, teaches a polarization control system, in which an optical polarization controller (e.g., polarization operating apparatus 20 in Figures 2 and 3) provided at a pre-stage of the optical polarization divider (e.g., polarization splitter 23 in Figures 2 and 3); a plurality of power monitoring units (e.g., the receivers 24 and 25 together with the differential amplifier 28; or the power monitors 42 and 43 in Figure 3) that respectively monitors optical signal powers on the paths; and a control circuit (e.g., the polarization control

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circuit 29 in Figures 2 and 3) that controls the optical polarization controller (20 in Figures 2 and 3) based on the optical signal powers (e.g., based on the differential signal b from the differential amplifier 28) such that output values of the optical signal powers monitored by the optical monitors become substantially equal (column 3, line 52-56, and column 4 line 53-57, to minimize the signal “b”, that is, output values of the optical signal powers monitored by the optical monitors become substantially equal).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the polarization control mechanism as taught by Naito et al to the system of Tomizawa et al so that the power to the two paths can be substantially equal, and the discriminators can use the substantially same decision threshold and make a desired decision, and then the system reliability can be increased.

8. Claims 17 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al (US 2003/0118345) as applied to claims 12 and 23 above, and in further view of Sawada et al (WO 03/026239; the corresponding English translation can be found in US 2004/0131368) and Tago et al (US 2004/0165895).

1). With regard to claim 17, Tomizawa et al disclose all of the subject matter as applied to claim 12 above, and Tomizawa et al further discloses a operational circuit (e.g., Figures 3-6, the Consensus logic and Selection Circuit), to which a plurality of discrimination results from the discriminators is respectively input (e.g., a plurality of discrimination results from the discriminators having different threshold values is respectively input), and a path selecting unit (e.g., Figures 3-6, the Selection Circuit 5)

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that selects an output result having a low bit error rate based on monitoring information ([0037], [0047], [0056], the output result selected by the Consensus logic and Selection Circuit has a “improved bit error characteristics”).

But Tomizawa et al does not expressly disclose wherein the discriminators are soft decision discriminators, a plurality of operational circuits is provided, to which a plurality of discrimination results from the soft decision discriminators is respectively input, and a bit-error-rate monitoring unit that monitors a bit error rate of an output result of each of the operational circuits; and a path selecting unit that selects an output result having a low bit error rate based on monitoring information of the bit-error-rate monitoring unit.

However, Sawada et al teaches a plurality of soft decision discriminators (e.g., 7 in Figures 3 and 61, or 12 in Figure 4), a probability density distribution estimation circuit (9 in Figures 3 and 61, the probability density distribution estimation circuit is equivalent to the bit error monitoring unit) that monitors the probability density distribution of an output result. And in Figure 14, Sawada et al also discloses a path selecting unit (e.g., selector 23 in Figure 14) that selects outputs based on monitoring information of probability density distribution estimation.

Sawada et al does not expressly state to use the bit error rate for selection. However, another prior art, Tago, teaches bit-error-rate monitoring units (e.g., 46/48 in Figure 8, or 136/138 in Figure 11) that monitor a bit error rate of an output result of each of the discriminators; and then based on monitoring information of the bit-error-rate

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monitoring units, an optimal decision threshold is determined and used to discriminate the received signals.

But, the combination of Tomizawa et al and Sawada et al and Taga does not expressly disclose a plurality of operational circuits. However, as discussed above, Tomizawa et al teaches a single operational circuit (e.g., Figures 3-6, the Consensus logic and Selection Circuit), and a plurality of discrimination results from a plurality discriminators with different threshold values is respectively input to the single operational circuit. As shown in Figure 3, the set of decision circuit 3-11 to 3-1n has a “threshold value 1”, and the set of decision circuit 3-21 to 3-2n has a “threshold value 2”, and the set of decision circuit 3-k1 to 3-kn has a “threshold value k”; that is, the single Consensus Logic 4 can process k sets of inputs. In applicant's disclosure, as shown in Figure 7, when a plurality of operational circuits is provided, each operational circuit only receives one set of input which corresponding to a specific decision threshold (Figure 7, e.g., the operational circuit 71-1 receives the results from the discriminators with decision threshold V_{th1} , and the operational circuit 71-2 receives the results from the discriminators with decision threshold V_{th2}). Although Tomizawa et al and Sawada et al and Taga do not specifically disclose a plurality of operational circuits (each receives specific discrimination results), such limitation are merely a matter of design choice and would have been obvious in the system of Tomizawa et al and Sawada et al and Taga. The combination of Tomizawa et al and Sawada et al and Taga teaches that a plurality of discrimination results from a plurality discriminators with different threshold values is respectively input to the operational circuit, and then a control signal is sent to the

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selection unit to obtain the desired result. The limitations in claim 17 do not define a patentably distinct invention over that in Tomizawa et al and Sawada et al and Taga since both the invention as a whole and Tomizawa et al and Sawada et al and Taga are directed to select and output the result with improved BER. To use a single operational circuit for all discriminators or use a plurality of operational circuits each responds a specific decision threshold is not critical for the invention as a whole and presents no new or unexpected results, so long as the desired control signal is sent and the result with improved BER is successfully obtained.

Tomizawa et al teaches an operational circuit and path selecting unit to obtain an output with improved bit error rate; and Sawada et al teaches a soft decision discriminator and the information from the probability density distribution can be used to determine the decision level and also can be used to select the outputs from the soft decision discriminators; and Taga etc teaches to directly use the BER to determine the decision threshold etc. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Sawada et al and Taga to the system of Tomizawa et al so that the bit error rate can be used to control the decision level of the soft decision discriminator and also be used to select the output with low BER, and the selection of the results can be made easier and convenient.

2). With regard to claim 28, Tomizawa et al disclose all of the subject matter as applied to claim 23 above, and Tomizawa et al further discloses a operational circuit (e.g., Figures 3-6, the Consensus logic and Selection Circuit), to which a plurality of discrimination results from the discriminators is respectively input (e.g., a plurality of

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discrimination results from the discriminators having different threshold values is respectively input), and a path selecting unit (e.g., Figures 3-6, the Selection Circuit 5) that selects an output result having a low bit error rate based on monitoring information ([0037], [0047], [0056], the output result selected by the Consensus logic and Selection Circuit has a “improved bit error characteristics”).

But Tomizawa et al does not expressly disclose wherein the discriminators are soft decision discriminators, and providing a plurality of operational circuits, to which a plurality of discrimination results from the soft decision discriminators is respectively input, and monitoring a bit-error-rate of an output result of each of the operational circuits; and selecting an output result having a low bit error rate based on monitoring information of the bit-error-rate monitoring unit.

However, Sawada et al teaches a plurality of soft decision discriminators (e.g., 7 in Figures 3 and 61, or 12 in Figure 4), a probability density distribution estimation circuit (9 in Figures 3 and 61, the probability density distribution estimation circuit is equivalent to the bit error monitoring unit) that monitors the probability density distribution of an output result. And in Figure 14, Sawada et al also discloses a path selecting unit (e.g., selector 23 in Figure 14) that selects outputs based on monitoring information of probability density distribution estimation.

Sawada et al does not expressly state to use the bit error rate for selection. However, another prior art, Tago, teaches bit-error-rate monitoring units (e.g., 46/48 in Figure 8, or 136/138 in Figure 11) that monitor a bit error rate of an output result of each of the discriminators; and then based on monitoring information of the bit-error-rate

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monitoring units, an optimal decision threshold is determined and used to discriminate the received signals.

But, the combination of Tomizawa et al and Sawada et al and Taga does not expressly disclose a plurality of operational circuits. However, as discussed above, Tomizawa et al teaches a single operational circuit (e.g., Figures 3-6, the Consensus logic and Selection Circuit), and a plurality of discrimination results from a plurality discriminators with different threshold values is respectively input to the single operational circuit. As shown in Figure 3, the set of decision circuit 3-11 to 3-1n has a “threshold value 1”, and the set of decision circuit 3-21 to 3-2n has a “threshold value 2”, and the set of decision circuit 3-k1 to 3-kn has a “threshold value k”; that is, the single Consensus Logic 4 can process k sets of inputs. In applicant's disclosure, as shown in Figure 7, when a plurality of operational circuits is provided, each operational circuit only receives one set of input which corresponding to a specific decision threshold (Figure 7, e.g., the operational circuit 71-1 receives the results from the discriminators with decision threshold V_{th1} , and the operational circuit 71-2 receives the results from the discriminators with decision threshold V_{th2}). Although Tomizawa et al and Sawada et al and Taga do not specifically disclose a plurality of operational circuits (each receives specific discrimination results), such limitation are merely a matter of design choice and would have been obvious in the system of Tomizawa et al and Sawada et al and Taga. The combination of Tomizawa et al and Sawada et al and Taga teaches that a plurality of discrimination results from a plurality discriminators with different threshold values is respectively input to the operational circuit, and then a control signal is sent to the

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selection unit to obtain the desired result. The limitations in claim 17 do not define a patentably distinct invention over that in Tomizawa et al and Sawada et al and Taga since both the invention as a whole and Tomizawa et al and Sawada et al and Taga are directed to select and output the result with improved BER. To use a single operational circuit for all discriminators or use a plurality of operational circuits each responds a specific decision threshold is not critical for the invention as a whole and presents no new or unexpected results, so long as the desired control signal is sent and the result with improved BER is successfully obtained.

Tomizawa et al teaches an operational circuit and path selecting unit to obtain an output with improved bit error rate; and Sawada et al teaches a soft decision discriminator and the information from the probability density distribution can be used to determine the decision level and also can be used to select the outputs from the soft decision discriminators; and Taga et al teaches to directly use the BER to determine the decision threshold etc. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Sawada et al and Taga to the system/method of Tomizawa et al so that the bit error rate can be used to control the decision level of the soft decision discriminator and also be used to select the output with low BER, and the selection of the results can be made easier and convenient.

9. Claims 19 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al (US 2003/0118345) as applied to claim 12 and 23 above, and further in view of Hayee et al (US 7,209,671).

1). With regard to claim 19, Tomizawa et al disclose all of the subject matter as applied to claim 12 above. But, Tomizawa et al does not expressly disclose wherein the operational circuit is a logical AND circuit.

However, Tomizawa et al discloses that the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit ([0072]), the threshold values of the discriminators can be higher than the standard threshold or lower than the standard threshold. And another prior art, Hayee et al, discloses an operational circuit (e.g., the Output Decision Circuit in Figure 2, or Figure 5) switches a function of the logical operation based on a control signal (Figure 6, and step 806 in Figure 8; column 7 line 22-64, column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

Hayee et al provide a reliable detection of the received data signal, and the best logic strategy choices can be loaded. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the logical AND circuit as taught by Hayee et al to the system of Tomizawa et al so that a reliable receiver with improved BER can be obtained.

2). With regard to claim 30, Tomizawa et al disclose all of the subject matter as applied to claim 23 above. But, Tomizawa et al does not expressly disclose wherein the predetermined logical operational is a logical AND circuit.

However, Tomizawa et al discloses that the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit ([0072]), the threshold values of the discriminators can be higher than the standard threshold or lower than the

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standard threshold. And another prior art, Hayee et al, discloses an operational circuit (e.g., the Output Decision Circuit in Figure 2, or Figure 5) switches a function of the logical operation based on a control signal (Figure 6, and step 806 in Figure 8; column 7 line 22-64, column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

Hayee et al provide a reliable detection of the received data signal, and the best logic strategy choices can be loaded. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the logical AND circuit as taught by Hayee et al to the system of Tomizawa et al so that a reliable receiver with improved BER can be obtained.

10. Claims 20, 21 and 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al (US 2003/0118345) as applied to claim 12 and 23 above, and further in view of Tago et al (US 2004/0165895) and Hayee et al (US 7,209,671).

1). With regard to claim 20, Tomizawa et al disclose all of the subject matter as applied to claim 12 above. But, Tomizawa et al does not expressly disclose a bit-error-rate monitoring unit that monitors a bit error rate of an output result of the operational circuit; and a discrimination-threshold control circuit that changes levels of the predetermined thresholds of the discriminators based on monitoring information of the bit-error-rate monitoring unit, wherein the operational circuit switches a function of the logical operation based on the levels of the predetermined thresholds of the discriminators.

However, Tago et al teaches a bit-error-rate monitoring unit (e.g., 46/48 in Figure 8, or 136/138 in Figure 11) that monitors a bit error rate of output results from one set of discriminators; and a discrimination-threshold control circuit (the Threshold generator in Figure 8, or the Threshold controller 140 in Figure 11) that changes levels of the predetermined thresholds of the discriminator (the Discriminator 40 in Figure 8, or 130 in Figure 11) based on monitoring information of the bit-error-rate monitoring units.

Tago et al teaches a system and method to rapidly determine the best threshold value for the discriminator and stably discriminate a received signal regardless of a time variation. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Tago to the system of Tomizawa et al so that the bit error rate can be used to control the decision level of the discriminators, and then the receiver can rapidly provide the optimum result.

But, Tago does not expressly disclose the operational circuit switches a function of the logical operation based on the levels of the predetermined thresholds of the discriminators.

However, Tomizawa et al discloses that the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit ([0072]), the threshold values of the discriminators can be higher than the standard threshold or lower than the standard threshold. And another prior art, Hayee et al, discloses an operational circuit (e.g., the Output Decision Circuit in Figure 2, or Figure 5) switches a function of the logical operation based on the predetermined thresholds of the discriminators or instruction from a look-up control signal (Figure 6, and step 806 in Figure 8; column 7

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line 22-64, column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

By selection of the logical operation, Hayee et al provide a reliable detection of the received data signal, and the best logic strategy choices can be loaded. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the mechanism of selecting the logical operation as taught by Hayee et al to the system of Tomizawa et al and Taga so that the best logic operation can be used for the specific decision levels of the discriminators, and the reliability of the receiver can be further improved.

2). With regard to claim 21, Tomizawa et al and Taga and Hayee et al disclose all of the subject matter as applied to claim 20 above. And the combination of Tomizawa et al and Taga and Hayee et al further discloses wherein the function of the logical operation includes a logical OR operation and a logical AND operation (Hayee et al: step 806 in Figure 8; column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

3). With regard to claim 31, Tomizawa et al disclose all of the subject matter as applied to claim 12 above. But, Tomizawa et al does not expressly discloses monitoring a bit error rate of an output result performed by said predetermined logical operation; and changing levels of the predetermined thresholds based on monitoring information of the bit-error-rate; and switching a function of the logical operation based on the levels of the predetermined thresholds.

However, Tago et al teaches a bit-error-rate monitoring unit (e.g., 46/48 in Figure 8, or 136/138 in Figure 11) that monitors a bit error rate of output results from one set of discriminators; and a discrimination-threshold control circuit (the Threshold generator in Figure 8, or the Threshold controller 140 in Figure 11) that changes levels of the predetermined thresholds of the discriminator (the Discriminator 40 in Figure 8, or 130 in Figure 11) based on monitoring information of the bit-error-rate monitoring units.

Tago et al teaches a system and method to rapidly determine the best threshold value for the discriminator and stably discriminate a received signal regardless of a time variation. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Tago to the system of Tomizawa et al so that the bit error rate can be used to control the decision level of the discriminators, and then the receiver can rapidly provide the optimum result.

But, Tago does not expressly disclose the operational circuit switches a function of the logical operation based on the levels of the predetermined thresholds.

However, Tomizawa et al discloses that the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit ([0072]), the threshold values of the discriminators can be higher than the standard threshold or lower than the standard threshold. And another prior art, Hayee et al, discloses an operational circuit (e.g., the Output Decision Circuit in Figure 2, or Figure 5) switches a function of the logical operation based on the predetermined thresholds of the discriminators or instruction from a look-up control signal (Figure 6, and step 806 in Figure 8; column 7

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line 22-64, column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

By selection of the logical operation, Hayee et al provide a reliable detection of the received data signal, and the best logic strategy choices can be loaded. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the mechanism of selecting the logical operation as taught by Hayee et al to the system and method of Tomizawa et al and Taga so that the best logic operation can be used for the specific decision levels of the discriminators, and the reliability of the receiver can be further improved.

4). With regard to claim 32, Tomizawa et al and Taga and Hayee et al disclose all of the subject matter as applied to claim 23 and 31 above. And the combination of Tomizawa et al and Taga and Hayee et al further discloses wherein the function of the logical operation includes a logical OR operation and a logical AND operation (Hayee et al: step 806 in Figure 8; column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

11. Claims 34-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al (US 2003/0118345) in view of Tago et al (US 2004/0165895) and Hayee et al (US 7,209,671).

1). With regard to claim 34, Tomizawa et al discloses an optical receiver (e.g., Figures 3-10) comprising:

an optical divider (e.g., the distribution circuit in Figures 3, 8 and 9 etc) that divides an optical input signal into a plurality of paths;

a plurality of optical-to-electrical converters (e.g., the photodetectors in Figures 3, 8 and 9 etc) that respectively converts the divided optical input signals into electrical signals;

a plurality of discriminators (e.g., the decision circuits in Figures 3, 8 and 9 etc) that respectively outputs discrimination results by discriminating the electrical signals output from the optical-to-electrical converters based on predetermined thresholds (the predetermined thresholds: threshold value 1, threshold value 2 etc, or threshold value H, threshold value L etc are used by the discriminators); and

an operational circuit (e.g., the Consensus Logic 4 with the Selection Circuit 5 in Figures 3, 8 and 9 etc) that performs a predetermined logical operation with the discrimination results output from the discriminators ([0045], [0069] and [0070] etc).

But, Tomizawa et al does not expressly disclose a bit-error-rate monitoring unit that monitors a bit error rate of an output result of the operational circuit; and a discrimination-threshold control circuit that changes levels of the predetermined thresholds of the discriminators based on monitoring information of the bit-error-rate monitoring unit, wherein the operational circuit has a logical OR function and a logical AND function, one of which is selected based on the levels of the predetermined thresholds of the discriminators, and performs the selected logical operation.

However, Tago et al teaches a bit-error-rate monitoring unit (e.g., 46/48 in Figure 8, or 136/138 in Figure 11) that monitors a bit error rate of output results from one set of discriminators; and a discrimination-threshold control circuit (the Threshold generator in Figure 8, or the Threshold controller 140 in Figure 11) that changes levels of the

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predetermined thresholds of the discriminator (the Discriminator 40 in Figure 8, or 130 in Figure 11) based on monitoring information of the bit-error-rate monitoring units.

Tago et al teaches a system and method to rapidly determine the best threshold value for the discriminator and stably discriminate a received signal regardless of a time variation. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Taga to the system of Tomizawa et al so that the bit error rate can be used to control the decision level of the discriminators, and then the receiver can rapidly provide the optimum result.

But, Tago does not expressly disclose wherein the operational circuit has a logical OR function and a logical AND function, one of which is selected based on the levels of the predetermined thresholds of the discriminators, and performs the selected logical operation.

However, Tomizawa et al discloses that the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit ([0072]), the threshold values of the discriminators can be higher than the standard threshold or lower than the standard threshold. And another prior art, Hayee et al, discloses an operational circuit (e.g., the Output Decision Circuit in Figure 2, or Figure 5) that has a logical OR function and a logical AND function, one of which is selected based on the levels of the predetermined thresholds of the discriminators or instruction from a look-up control signal, and performs the selected logical operation (Figure 6, and step 806 in Figure 8; column 7 line 22-64, column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

By selection of the logical operation, Hayee et al provide a reliable detection of the received data signal, and the best logic strategy choices can be loaded. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the mechanism of selecting the logical operation as taught by Hayee et al to the system of Tomizawa et al and Taga so that the best logic operation can be used for the specific decision levels of the discriminators, and the reliability of the receiver can be further improved.

2). With regard to claim 35, Tomizawa et al and Taga and Hayee et al disclose all of the subject matter as applied to claim 34 above. But, Tomizawa et al and Taga and Hayee et al does not expressly disclose wherein when the level of the predetermined thresholds is set to a value smaller than an optimum threshold that is used when discriminating the optical input signals divided into the paths with a single discriminator, the logical AND function is selected, and when the level of the predetermined thresholds is set to a value larger than the optimum threshold, the logical OR function is selected.

However, Tomizawa et al discloses that the threshold values of the discriminators can be higher than the standard threshold or lower than the standard threshold, and the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit based on whether the threshold value of the decision circuit is higher or lower than the standard threshold value ([0072]). And Hayee et al teaches to select the best logic strategy (column 8 line 32-46; “[t]he controller may then generate logical permutations 706, e.g. OR, AND, XOR, etc based on these detector levels. The controller may then compare a known training sequence or pattern 708 with the logic

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permutations to select the best logic strategy for each bit or sequence of bits 712”).

Therefore, based on the teaching and suggestion of Tomizawa et al and Hayee et al, it is obvious to one skilled in the art, without undue experiment, to select the logical AND function when the level of the predetermined thresholds is set to a value smaller than an optimum threshold that is used when discriminating the optical input signals divided into the paths with a single discriminator, and to select the logical OR function when the level of the predetermined thresholds is set to a value larger than the optimum threshold, and then the system reliability is enhanced.

3). With regard to claim 36, Tomizawa et al discloses an optical communication system (e.g., Figures 3-10) comprising:

- an optical transmitter (e.g., the optical transmitter shown in Figures 5-7) that transmits an optical signal; and

- an optical receiver (e.g., Figures 3-10) that receives the optical signal transmitted from the optical transmitter, wherein

 - the optical receiver includes

 - an optical divider (e.g., the distribution circuit in Figures 3, 8 and 9 etc) that divides an optical input signal into a plurality of paths;

 - a plurality of optical-to-electrical converters (e.g., the photodetectors in Figures 3, 8 and 9 etc) that respectively converts the divided optical input signals into electrical signals;

 - a plurality of discriminators (e.g., the decision circuits in Figures 3, 8 and 9 etc) that respectively outputs discrimination results by discriminating the electrical signals

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output from the optical-to-electrical converters based on predetermined thresholds (the predetermined thresholds: threshold value 1, threshold value 2 etc, or threshold value H, threshold value L etc are used by the discriminators); and

an operational circuit (e.g., the Consensus Logic 4 with the Selection Circuit 5 in Figures 3, 8 and 9 etc) that performs a predetermined logical operation with the discrimination results output from the discriminators ([0045], [0069] and [0070] etc).

But, Tomizawa et al does not expressly disclose a bit-error-rate monitoring unit that monitors a bit error rate of an output result of the operational circuit; and a discrimination-threshold control circuit that changes levels of the predetermined thresholds of the discriminators based on monitoring information of the bit-error-rate monitoring unit, wherein the operational circuit has a logical OR function and a logical AND function, one of which is selected based on the levels of the predetermined thresholds of the discriminators, and performs the selected logical operation.

However, Tago et al teaches a bit-error-rate monitoring unit (e.g., 46/48 in Figure 8, or 136/138 in Figure 11) that monitors a bit error rate of output results from one set of discriminators; and a discrimination-threshold control circuit (the Threshold generator in Figure 8, or the Threshold controller 140 in Figure 11) that changes levels of the predetermined thresholds of the discriminator (the Discriminator 40 in Figure 8, or 130 in Figure 11) based on monitoring information of the bit-error-rate monitoring units.

Tago et al teaches a system and method to rapidly determine the best threshold value for the discriminator and stably discriminate a received signal regardless of a time variation. Therefore, it would have been obvious to one of ordinary skill in the art at the

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time the invention was made to apply the teaching of Taga to the system of Tomizawa et al so that the bit error rate can be used to control the decision level of the discriminators, and then the receiver can rapidly provide the optimum result.

But, Tago does not expressly disclose wherein the operational circuit has a logical OR function and a logical AND function, one of which is selected based on the levels of the predetermined thresholds of the discriminators, and performs the selected logical operation.

However, Tomizawa et al discloses that the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit ([0072]), the threshold values of the discriminators can be higher than the standard threshold or lower than the standard threshold. And another prior art, Hayee et al, discloses an operational circuit (e.g., the Output Decision Circuit in Figure 2, or Figure 5) that has a logical OR function and a logical AND function, one of which is selected based on the levels of the predetermined thresholds of the discriminators or instruction from a look-up control signal, and performs the selected logical operation (Figure 6, and step 806 in Figure 8; column 7 line 22-64, column 8 line 18-24, and column 9 line 26-36; the output decision circuit applies a selected logic function: OR, AND and XOR).

By selection of the logical operation, Hayee et al provide a reliable detection of the received data signal, and the best logic strategy choices can be loaded. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the mechanism of selecting the logical operation as taught by Hayee et al to the system of Tomizawa et al and Taga so that the best logic operation can be used

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for the specific decision levels of the discriminators, and the reliability of the receiver can be further improved.

4). With regard to claim 37, Tomizawa et al and Taga and Hayee et al disclose all of the subject matter as applied to claim 34 above. But, Tomizawa et al and Taga and Hayee et al does not expressly disclose wherein when the level of the predetermined thresholds is set to a value smaller than an optimum threshold that is used when discriminating the optical input signals divided into the paths with a single discriminator, the logical AND function is selected, and when the level of the predetermined thresholds is set to a value larger than the optimum threshold, the logical OR function is selected.

However, Tomizawa et al discloses that the threshold values of the discriminators can be higher than the standard threshold or lower than the standard threshold, and the control circuit (consensus logic) can be realized using an OR circuit or an Exclusive OR circuit based on whether the threshold value of the decision circuit is higher or lower than the standard threshold value ([0072]). And Hayee et al teaches to select the best logic strategy (column 8 line 32-46; “[t]he controller may then generate logical permutations 706, e.g. OR, AND, XOR, etc based on these detector levels. The controller may then compare a known training sequence or pattern 708 with the logic permutations to select the best logic strategy for each bit or sequence of bits 712”). Therefore, based on the teaching and suggestion of Tomizawa et al and Hayee et al, it is obvious to one skilled in the art, without undue experiment, to select the logical AND function when the level of the predetermined thresholds is set to a value smaller than an optimum threshold that is used when discriminating the optical input signals

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divided into the paths with a single discriminator, and to select the logical OR function when the level of the predetermined thresholds is set to a value larger than the optimum threshold, and then the system reliability is enhanced.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Monday-Friday, 8:30 am - 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Li Liu/

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Primary Examiner, Art Unit 2613

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